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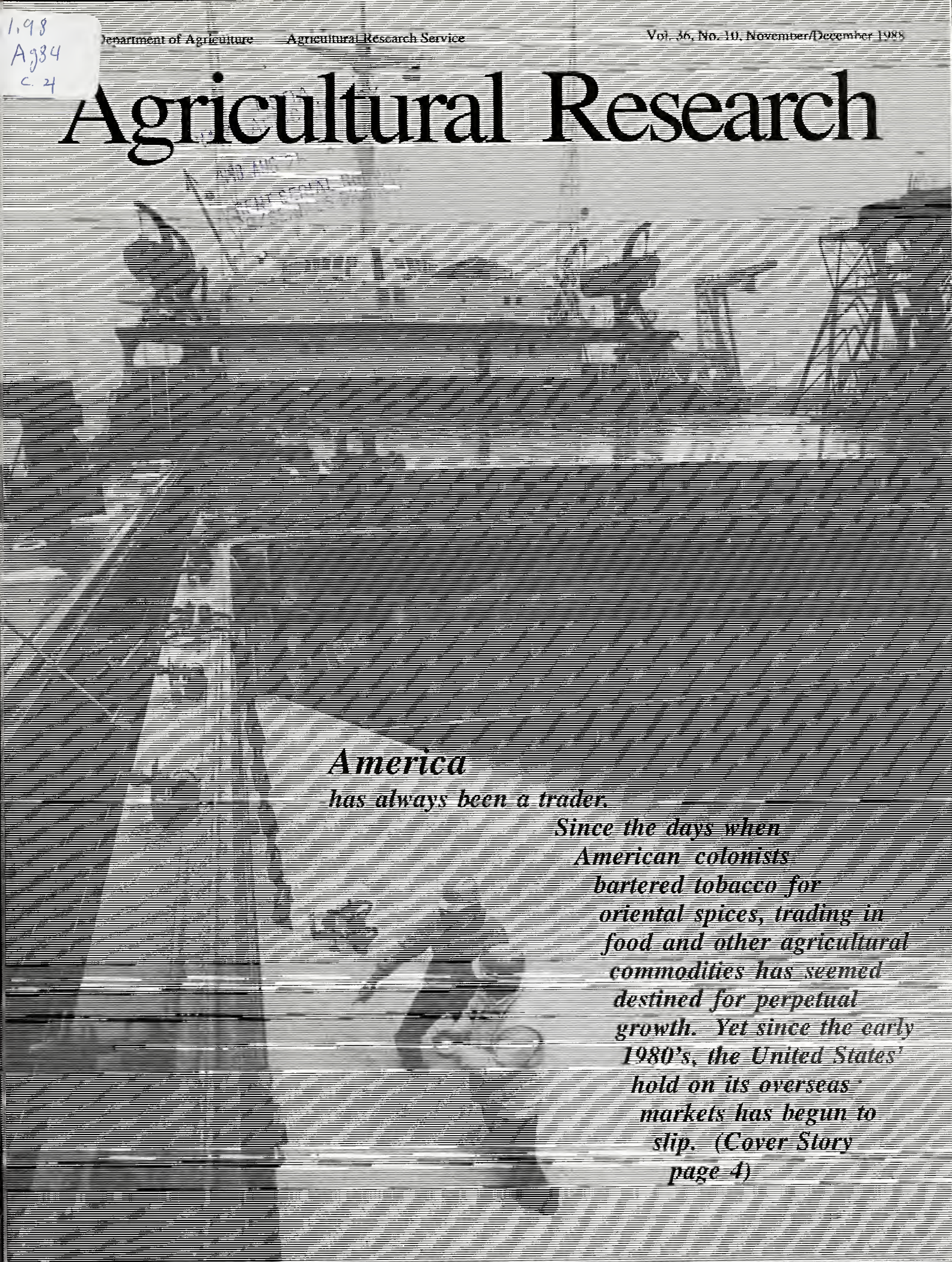
Department of Agriculture Agricultural Research Service Vol. 36, No. 10, November/December 1988

Agricultural Research



America
has always been a trader.

Since the days when American colonists bartered tobacco for oriental spices, trading in food and other agricultural commodities has seemed destined for perpetual growth. Yet since the early 1980's, the United States' hold on its overseas markets has begun to slip. ***(Cover Story page 4)***

Janice M. Miller Distinguished Scientist

In the early 1950's, a fifth grader from Mentor, Kansas (pop. 75), made a decision. Although she didn't live on a farm, she liked animals. She would become a veterinarian and work in animal research. She would study conscientiously and stick to her goal.

In 1972, having completed veterinary school at Kansas State University, at Manhattan, (she was one of two women in her class) and graduate school at the University of Wisconsin, Janice M. Miller began a distinguished career that attained her agency's highest award for achievement in science.

Her promise was evident, long before she departed from academia. As a graduate student, she had already been the first to identify the virus that causes cattle leukemia.

Today, Dr. Miller has added to our basic knowledge of two viral diseases: retrovirus (in the same family as the AIDS virus) and herpes virus infections.

As a direct result of her work, the United States has the means to eradicate cattle leukemia. Other countries have also adopted her techniques to control or eradicate this disease. In addition, her work applies directly to other significant viral diseases of cattle and also applies in general to human disease problems.

In the late 1960's as a young researcher, Janice Miller teamed up with University of Wisconsin researchers Lyle D. Miller, Carl Olson, and Kenneth G. Gillette. This group found and isolated the C-type virus from leukemic cattle. Miller, strong in her belief, proposed this virus as a possible causative agent for bovine leukemia. Most viruses associated with other forms of leukemia are similarly classified by structure as C-type viruses.

Miller then joined ARS and began working with veterinary medical officer Martin Van Der Maaten at Ames, Iowa. Together they developed culturing and testing methods to determine the actual cause of cattle leukemia. The two ARS researchers as well as several others around the world used these methods to prove the virus she had originally helped discover was in fact the cause of the disease. Subsequently, Miller refined the diagnostic test, which was developed for commercial use in bovine leukemia control and eradication programs.

The work was timely, coinciding with international restrictions on transporting infected cattle.

Dr. Miller's diagnostic test—the agar-gel immunodiffusion test—finds blood antibodies in infected animals. Because of its simplicity, producers are able to conduct on-farm eradication programs. And since the test can identify both infected and noninfected animals, it can be used to assure foreign countries that exported cattle and cattle semen are free of this virus.

The test is now commercially produced and marketed by a private firm as the Leukassay-B diagnostic kit. USDA's Animal and Plant Health Inspection Service uses the kit to satisfy health certification requirements for exporting cattle and cattle products.

At the time of Miller's discovery, a major question in cancer research was whether or not viruses caused cancer in large mammals. She found it to be true in cattle, although it has never been verified for other domesticated food animals. After her discovery of the leukemia virus in cattle, medical researchers discovered the leukemia virus in humans.

She also showed that the virus causing infectious bovine rhinotracheitis (IBR, Red Nose) can infect and kill young fetuses, a discovery that promises to help improve reproductive efficiency in cattle. The virus was not considered an important cause of fetal death until her work. She concluded from her studies that pregnant cows should not be vaccinated for IBR at any time during their pregnancy because of increased risk of fetal death.

As an international leader in bovine leukemia virus research, Miller has shared her expertise with visiting scientists from Canada, Denmark, Sweden, Trinidad-Tobago, India, Romania, Poland, West Germany, Mexico, Venezuela, and the Soviet Union. She serves as lead scientist for the Bovine Viral Reproductive Disease Research Project.

BRUCE FRITZ

On November 15, 1988, Janice M. Miller will be recognized as the 1988 "Distinguished Scientist of the Year." The award is the highest conferred by the Agricultural Research Service for scientific achievement and leadership.—*By **Linda Cooke**, ARS.*

Agricultural Research

Cover: Agricultural Research Service scientists check U.S. soybeans for shipping damage or other quality changes aboard a ship in Amsterdam, The Netherlands. Photo by Tim McCabe. (88BW1029-10)

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Vol. 36, No. 10
November/December 1988

Editor: Lloyd E. McLaughlin
Associate Editor: Regina A. Wiggen
Photography Editor: Robert C. Bjork

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Agricultural Research is published 10 times per year by the Agricultural Research Service (ARS), U.S. Department of Agriculture, Washington, DC 20250. The Secretary of Agriculture has determined that publication of this periodical is necessary in the transaction of the public business required by law of the Department.

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Subscriptions: $11.00 for 1 year (10 issues) in the United States or $13.75 foreign. Prices subject to change and should be verified after December 31, 1988. Send orders to Superintendent of Documents, Government Printing Office, Washington, DC 20402. Request *Agricultural Research,* stock number 701 006 00000 3.

Magazine inquiries or comments should be addressed to: The Editor, Information Staff, Room 316, Bldg. 005, Beltsville Agricultural Research Center-West, Beltsville, MD 20705. Telephone: (301) 344-3280. When writing to request address changes or deletions, please include a recent address label.

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Exports: Overcoming the Obstacles

While many factors have contributed to the recent decline in agricultural exports—weather conditions, changes in the value of the dollar, growing competition abroad—Americans are looking to research and technology as trump cards in the high-stakes game of world trade.

New technology from scientific research is today opening export markets, developing new products, maintaining product quality, and keeping U.S. farm goods competitive on foreign markets.

The grapefruit is one example. Ethylene dibromide, a chemical fumigant, was used to control fruit flies until it was banned. That left shippers in need of an alternative. So Thurman T. Hatton, Jr., with the Agricultural Research Service's U.S. Horticultural Lab in Orlando, Florida, in cooperation with Florida state researchers and the citrus industry, found a way to slowly condition grapefruit to cold temperatures. This allowed agency scientists at Miami to use cold to kill fruit fly larvae in grapefruit without damaging the fruit.

Grapefruit are cooled at 60°F for 7 days before dropping the temperature to 34°F during the 3-week trip to Japan or Europe. This allows the fruit to adjust slowly to the lower temperatures and prevents pitting and browning of the peel or other chilling injuries, explains Hatton, head of the lab's Export and Quality Research group.

Using this technology enabled Florida growers to ship about 6 million cartons of grapefruit, worth about $70 million, to Japan this year, according to Richard Kinney, executive vice president of the Florida Citrus Packers Association, in Lakeland. That's almost half the state's grapefruit exports.

"Cold treatment has maintained our most lucrative export market—Japan," Kinney says. "It's been a savior."

While fruit flies are getting the chill in grapefruit, the pests are taking the heat in Hawaiian papayas. ARS scientists in Hilo, Hawaii, cooperating with USDA's Animal and Plant Health Inspection Service in Hilo, found a way to kill fruit flies in papayas by circulating hot air around the fruit. For 6 1/2 hours, the fruit is gradually heated to 117°F, long enough to kill any stray flies in it.

Growers in California and the Pacific Northwest are also benefiting from ARS research to rid their fruit of insect pests. Scientists in Yakima, Washington, developed a methyl bromide fumigation treatment in the 1970's to kill codling moths in cherries. Since Japan began accepting Pacific Northwest cherries in 1978 and California cherries in 1987, growers from those states have shipped about $108 million worth of cherries there.

"Without the research, there would have been no hope of getting cherries into Japan, because of the codling moth," says Ken Severn, president of the Northwest Cherry Growers Association in Yakima. He estimates that each year, growers will ship an average of about 600,000 boxes of cherries to Japan. This year, that's worth about $15 million as it leaves the United States. By the time the cherries reach Japan, they'll sell for $3 to $6 a pound retail.

Apples may be next. ARS scientists have developed a similar treatment for codling moths in apples and have submitted it to the Japanese government for approval. If Japan accepts the procedure, the apple industry estimates exports of 1 million cartons—about 40 million pounds—the first year, with a possible market as high as 400 million pounds, says Harold R. Moffitt, an agency entomologist at Yakima. He has seen apples on the Japanese gift market sell for as much as $3 or more each.

Japanese consumers can also find California unshelled walnuts on supermarket shelves. Scientists at the ARS Horticultural Crops Research Lab in Fresno, California, developed a methyl bromide fumigation treatment to kill codling moths inside walnuts shells. In 1988, California is expected to export more than $4 million of unshelled walnuts to Japan.

Quality Concerns Hurt U.S. Competitive Edge

Research not only helps exporters compete against insects, but also against other countries. Foreign competition has become particularly stiff for soybeans and peanuts.

America's hold on the export market for these commodities has slipped. American soybeans still top the world market, but the U.S. share has slipped from 92 percent in 1982 to an estimated 73 percent in 1988, primarily because of competition from Brazil and Argentina. The United States was the world's leading peanut exporter but is now second to China.

The main reason? Quality. For peanuts, flavor, foreign material, and aflatoxin contamination are all important quality considerations. Importers are considering tighter restrictions on aflatoxin, which is produced by certain fungi and can contaminate peanuts, primarily under drought stress or poor storage conditions. Federal regulations require these poor-quality peanuts to be discarded or processed into lower-value oil—a procedure that destroys the aflatoxin.

TIM McCABE

BARRY FITZGERALD

TOP: How does U.S.-grown fruit compare to rival fruit in European markets? ARS agricultural specialist Anton Bongers (left) and Gordon Rasmussen, ARS plant physiologist, scout the competition at Amsterdam: oranges from Morocco, and apples from Chile and Argentina. (88BE1025-9)
ABOVE: Caribbean fruit fly (0478X440-15A)

ARS and the U.S. peanut industry have joined to evaluate the peanut marketing and grading system and are looking for ways to improve the quality of the $1 billion crop. As part of the project, 400,000 pounds of U.S. peanuts will be cleaned by a new machine developed jointly by the peanut industry and scientists at the National Peanut Research Laboratory in Dawson, Georgia.

"This machine separates broken shells, loose and immature kernels, sticks, pebbles, and other foreign material from high-quality unshelled peanuts," says Paul D. Blankenship, an agricultural engineer at the Dawson lab. From 15,000 to 30,000 pieces of this debris may be in a 1,000-pound load of unshelled peanuts that mechanical harvesters scoop up.

A Better Image for U.S. Crops

Jeannette Anderson, director of international marketing for the National Peanut Council, says these research projects and others are helping maintain high quality. The peanut council is also working with agency scientists at Dawson and New Orleans on a study comparing the flavor of U.S. peanuts with those from America's chief competitors: China, Malawi, and Argentina. According to John R. Vercellotti, research leader of the ARS Food Flavor Quality group in New Orleans, a trained flavor panel says U.S. peanuts had the highest intensity of roasted peanut and other positive flavors and less bitterness and other off-flavors.

Because of increased competition from Brazil and Argentina, quality has become more important for soybeans, says ARS' Timothy L. Mounts, research leader of the Vegetable Oil Research unit at Peoria, Illinois.

So ARS and the soybean industry are comparing the oil content and overall quality of soybeans from the United States, Argentina, and Brazil. Mounts says the study has confirmed that on arrival at foreign ports American soybeans have higher oil quality than soybeans from the two South American competitors.

"This is important for us because as markets become more competitive, buyers insist on better quality," says Keith Smith, vice president of research for the American Soybean Association. "We've used the study's findings as evidence of the high quality of American soybeans."

Wheat and other grain can also be infested with insects. Last year, for example, some shipments of U.S. grain contained live insects when they arrived at the Soviet Union. So ARS scientists and Soviet researchers conducted a joint study last winter using phosphine gas to kill insects in 2.6 million bushels of wheat as it was shipped from Galveston, Texas, to the Soviet Union. This procedure was developed by agency scientists in Savannah, Georgia.

The study confirmed that phosphine gas, if properly circulated through wheat transported aboard ship, kills all the insects, according to Robert Davis, director of the ARS Stored-Product Insects Research and Development Laboratory in Savannah. As a result, the Soviets will use the procedure for U.S. wheat shipments of more than 40,000 tons and may use it for corn shipments of that size as well.

An Overseas Ally

Many export studies are assisted by ARS' European Marketing Research Center based in Rotterdam, The Netherlands. Founded in 1969, the center helps growers, shippers, and associations evaluate and maintain the quality of their exports.

"In recent years, we've helped improve the export of a variety of commodities, including raisins, soybeans, peanuts, kiwi, grapefruit, blueberries, and ornamental plants," says Gordon K. Rasmussen, research leader at the Center.

The center does this in a number of ways. For example, it conducts joint test shipments with ARS labs in the United States, evaluating the condition of food when it arrives after a 2- or 3-week trip. What is the quality of the fruit or grain? If it has been damaged, how did it happened? How can the problem be corrected?

In the soybean and peanut studies, the center collected samples at Rotterdam—after they had undergone the rigors of shipping—and sent them back to the United States for analysis. "It gives us a truer picture of U.S. products as they appear on the European market," Rasmussen says.

The condition of ornamental trees arriving at Rotterdam was also a problem. Europeans want ferns for floral decorations and palms, ficuses, and other trees to landscape the interiors of shopping malls and other buildings, Rasmussen says. But some U.S. shipments were arriving with yellowed leaves or with few leaves.

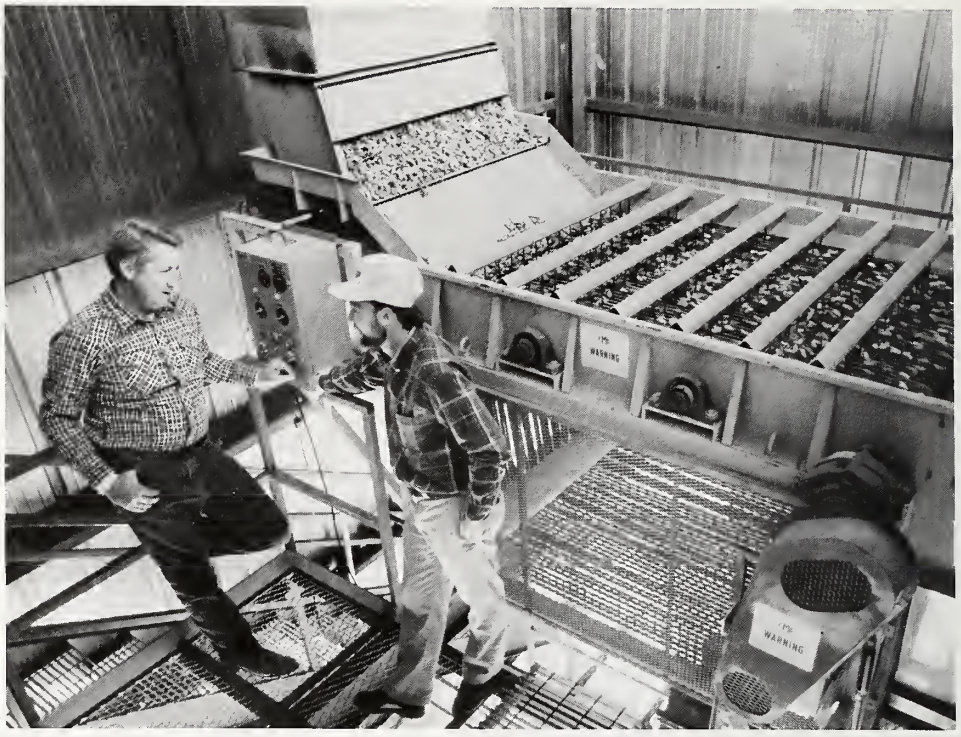
To improve their condition during shipping, it's best to store the trees between 55°F and 58°F and to reduce watering and fertilizing beforehand, says Lawrence A. Risse, an agricultural marketing specialist at Orlando who conducts test shipments with the center. "This hardens the tree—it forces it into a semidormant state so it can withstand the trip," Risse says.

Two American favorite foods that have export possibilities in the European and Japanese markets, Risse says, are small watermelons and sweet corn. The 5- to-12-pound melons, Mickylee and Minilee, were developed by the University of Florida and released in 1986. They are firmer, crisper, and sweeter than the standard 20- or 25-pound melons.

"Importers like the small melons because produce is often sold in small shops and by street vendors in Europe," Risse says. "The large melons aren't as popular with Europeans."

Because of a shortage of seed, few of the small melons have been planted in Florida this year, Risse says, "but I think next year we'll see a lot more acreage as seed becomes available."

Also popular on European markets are the super sweet corn varieties. These varieties have about 16 percent sugar—about double the amount in current varieties such as Silver Queen. The advantage of the super sweet corn is that it can be shipped overseas and still stay sweet. Tests show that super sweet corn after 3 weeks' storage at 34°F still has 3 or 4 percent more sugar than freshly picked Silver Queen.



ROB FLYNN

ARS engineer Paul Blankenship and Severn (North Carolina) Peanut Company vice president Dallas Barnes discuss operation of ARS-designed peanut cleaning machine. (88BW1836-15A)

ROB FLYNN

Peanut trash collected from a test run (right) will be sent to the ARS National Peanut Research Laboratory at Dawson, Georgia, for evaluation. (88BW1837-10)

The best way to pack it, Risse's studies show, is in plastic shrink wrapping with the husk on. One strip of the husk is torn off each ear, giving buyers a window to see the corn on the cob.

There's also a market for American blueberries, says William R. Miller, an agricultural marketing specialist at Orlando. He's working on a study to ship mechanically harvested blueberries to Europe in controlled atmosphere storage. Controlled atmosphere for blueberries is about 17 percent carbon dioxide, 4 percent oxygen, and the rest nitrogen. In contrast, normal air is only about 0.03 percent carbon dioxide with 21 percent oxygen and the balance nitrogen.

"The higher carbon dioxide storage tends to firm up mechanically harvested blueberries and extend their shelf life," Miller says. He's working with the Rotterdam center, Doyle A. Smittle of the University of Georgia, and with a private company that is using its machinery and plastic bags to pack the berries in the controlled atmosphere.

Another export commodity benefiting from ARS technology is rice bran. Bran—the thin layer surrounding the

Japan Okays California Nectarines

With the sale of the first California nectarines in Tokyo supermarkets this summer, Japanese consumers confirmed the value of export-oriented research in the United States.

Japan was able to lower its long-standing ban against the U.S.- grown fruit in part because ARS researchers in Fresno, California, had fine-tuned a fumigation treatment aimed at killing eggs or larvae of the codling moth in nectarines.

Even though nectarines aren't a first choice of the codling moth, the Japanese feared shipments might contain the insect. And once imported, the moth might infest Japanese orchards.

The treatment, which uses a moderate dose of the fumigant methyl bromide, doesn't damage the taste or texture of the ripe fruit, says Patrick V. Vail, director of ARS' Horticultural Crops Research Laboratory in Fresno.

Vail and colleagues Victoria Y. Yokoyama, John M. Harvey, C. Max Harris, Charles E. Curtis, and Preston L. Hartsell worked with thousands of nectarines and more than 100,000 codling moth eggs in tailoring a fumigation procedure to meet the Japanese government's rigorous standards. California's nectarine growers funded portions of the research through a marketing organization, the California Tree Fruit Agreement.

Two California fruit shippers, Mayfair Packing Co. of San Jose and NABROF, Inc., of Dinuba (near Fresno), rushed nectarines to Japanese buyers before this year's July 25 cutoff date. (That shipping restriction, an outcome of trade negotiations with Japan, will be gradually relaxed so that by 1991 U.S. growers will be able to ship nectarines any time.)

Although Mayfair sent only a few shipments by air, export promotion manager Angelia T. Brown says the company plans to ship more of the fruit next season.

NABROF shipped 36,000 flats of 11 pounds each, by air and by boat, according to company president Glenn T. Nakagawa. That represented a half-million dollars in sales.

The export effort "went very well, considering that the go-ahead came through when we were down to the last 30 days of a 75-day growing season," Nakagawa says.

NABROF's first shipment was accompanied—from packing and loading at the California packinghouse through unloading and customs and agriculture inspections at Tokyo's Narita airport—by ARS agricultural marketing specialist R. Tom Hinsch of the Fresno laboratory.

He regularly checked the produce for bruises, cuts, punctures, and other surface defects and sampled the sugar content, temperature, and firmness to find out how the nectarines fared on the long route from California grower to Japanese grocer.

Soft, ripe nectarines that are ready to eat—the kind that are the most difficult to ship without damage—were the most popular, Hinsch says. Unlike American shoppers, who readily buy firm, partially ripened fruit and let it ripen at home, Japanese consumers want to eat the fruit the same day they buy it. Some nectarines sold for as much as $2 each—at a time when you could buy a nectarine for 33 cents in California.

Single-layer flats shipped this year are only half the size of the cartons sold in the United States. But packs that are even smaller might be needed in order to get nectarines into more of Japan's many small retail outlets, Hinsch says. "Smaller packs are less of a gamble for the corner grocer," he explains. "If more grocers offer nectarines, that means wider distribution and higher visibility for a fruit that's still new to many Japanese shoppers."

California produces almost all of the U.S. nectarine crop, worth $65.5 million in 1987.—By **Marcia Wood**, ARS.

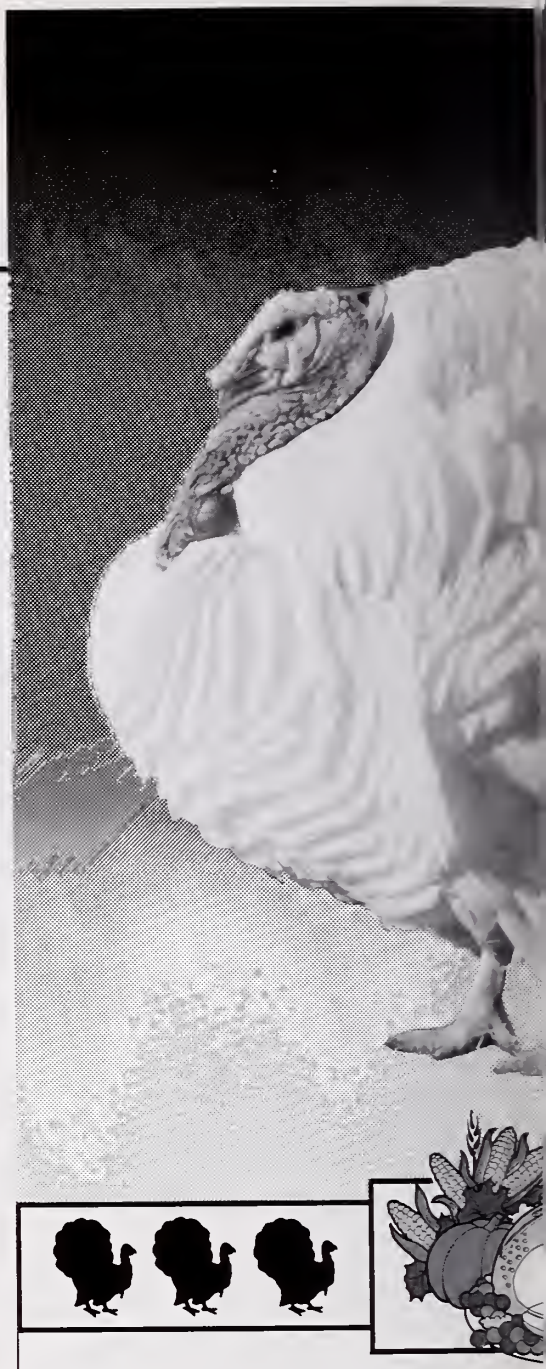
Patrick V. Vail and ARS colleagues mentioned here are at the USDA-ARS Horticultural Crops Research Laboratory, 2021 South Peach Ave., Fresno, CA 93727 (209) 453-3000. ♦

white rice kernel—is increasingly being exported to Taiwan, Korea, and Japan because a research team led by Robin M. Saunders at the Western Regional Research Center in Albany, California, developed a way to prevent the oil in the bran from chemically changing and becoming inedible.

Rice Bran Industries of Los Angeles has exported an average of 350 to 400 tons of stabilized bran for the first 8 months of this year. And Brady International, near Los Angeles, exported more than 1,000 tons of stabilized bran in 1987. The corporation, through a joint venture with the government of India, is supplying the processing machinery and expertise to rice mills so India can stabilize bran from rice it grows.—By **Sean Adams**, formerly ARS.

[If you are interested in contacting scientists mentioned in this article, write or telephone the Editor, Agricultural Research, Bldg. 005, Beltsville Agricultural Research Center-West, Beltsville, MD 20705 (301) 344-3280.] ♦

Now Starring on Your



Ah, Thanksgiving—that all-American holiday, appropriately symbolized by that most American bird, the turkey. A creature so intertwined with the nation's history that Benjamin Franklin actively promoted it as the best choice for the national symbol, calling it a "true original native of America."

But Franklin might scarcely believe his eyes if he could see today's turkey, with its blossomed breast and extra servings of favored white meat. That the American public has taken to turkey with new vigor is evidenced by per capita consumption, up from a paltry 2.9 pounds in 1940 to 15.2 pounds in 1987.

Turkey's burgeoning popularity has been marked by nearly a 50-percent gain just since 1980. Most of this increase can be attributed largely to the proliferation of processed turkey products: turkey ham, turkey bologna, turkey franks, and the like.

Back in the days before anyone had ever heard of turkey ham, the U.S. Department of Agriculture was already helping pull turkey production out of the doldrums with a bird that belied the proposition that bigger is always better.

The bulky bird of post-World War II days tended to outstay its welcome, lingering on in the refrigerator as leftovers. So American housewives often steered clear of the turkey except on special occasions.

In those days before packaged parts were readily available, a smaller, more manageable bird would have been a welcome addition at American dinner tables.

Just such a bird emerged from more than a decade of work by USDA's Agricultural Research Service. Named the Beltsville Small White after the Beltsville, Maryland, research center where it was developed, it became a hit in the turkey industry.

By 1954, only 7 years after its first commercial production, it represented 28 percent of the 67 million turkeys produced that year. Although the Small White has grown larger over the years, today's version still weighs in at the market at only about 9 pounds.

The Beltsville Small White lives on these days primarily in the American turkey gene pool, where it is prized for its reproductive capability. According to Thomas J. Sexton, a poultry physiologist and director of ARS' Livestock and Poultry Sciences Institute at Beltsville, the Small White female could crank out more than 100 eggs in 6 months, handily topping the output of other commercial breeds.

Reproduction was the focus when the Agricultural Research Service made turkey history a second time in 1980. That's when Sexton and fellow researchers hit upon the Beltsville Poultry Semen Extender, a mixture that would allow turkey semen to be stored for 6 to 8 hours without losing its viability. With the Extender came an increase in the volume of useable semen and less need for as many toms.

Artificial insemination has long been a fact of life in the turkey industry, Sexton explains.

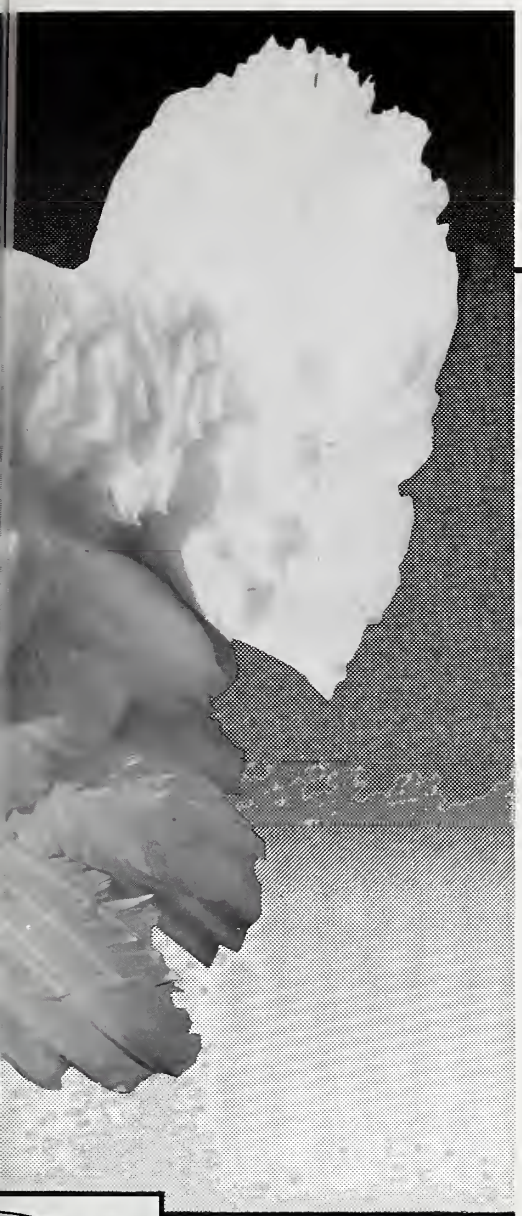
"All commercial turkeys are artificially inseminated," he says. "If we left it up to nature, the reproductive rate of domestic turkeys would be about half of what it now is. If you artificially inseminate a flock, you can expect a 90 to 95 percent fertility rate in the eggs produced. But in a naturally mated flock, you might get 45 to 50 percent.

"The trouble is that the male turkey is now so much bigger than the fe-

Where Are the Turkeys?

According to economist Lee Christensen of USDA's Economic Research Service, about 43 percent of the turkeys produced in 1986 came from three states. North Carolina, the number one producer, is followed by Minnesota and California.

According to the Census of Agriculture, the south Atlantic region was home to the largest turkey farms—operations there averaged 40,000 turkeys. The west north central and western regions were close behind.



Thanksgiving Table

Regional shifts in turkey production have been influenced by various changes in the costs and relative profitability of turkey operations. According to a 1985 USDA study, the Midwest initially benefited from abundantly available, inexpensive feeds, but many producers redirected their resources into more profitable operations when the price of grain rose in the 1970's.

At the same time, the South, with less productive land and a good supply of low-cost labor, found turkeys to be a profitable enterprise.

male, you have incompatibility in mating. The average male breeder may be 40 to 50 pounds, while the average female is 25 pounds or less."

"And there's a difference in attitude in these big males. They're more interested in eating than mating."

In the days before the Beltsville Poultry Semen Extender, "you had to use turkey semen within 30 minutes," Sexton says. "This meant that the males had to be on the same farm with the females.

However, the introduction of the semen extender sent most of the toms on their way to market, and allowed most of the remaining males to be gathered together on turkey "stud farms."

There, semen is collected twice a week. Once mixed with the extender, it can be sent to every outpost of hens in a company's operation. Now commercial producers are able to artificially inseminate as many as 40 hens a week per male, Sexton says: "Before the dilution and viability technology, it was maybe one male to 10 hens."

At today's turkey stud farms, the tom's time in the sun is relatively brief; after only about a year, he's off to market. It's not that his reproductive capability is depleted, it's simply because another generation has emerged, presumably with even more genetic merit.

Research continues on improved turkey productivity. Edward J. Robel, Jr., of ARS' Avian Physiology Laboratory at Beltsville has found that 3 to 4 percent more turkey eggs will hatch when injected with a vitamin called biotin. A hatchability increase of this size in the 350 million eggs set annually in the United States would mean a $12 million to $13 million increase in profits for turkey producers.

ARS researchers have also developed an automated system for injecting turkey eggs with the vitamin.

From smaller turkeys to bigger hatches, ARS research had added up to one result: "More turkey available to the consumer," says Sexton. "And ARS research will continue to work toward this goal."—By **Sandy Miller Hays**, ARS.

Thomas J. Sexton is at the USDA-ARS Livestock and Poultry Sciences Institute, Bldg. 200, Room 217, BARC-E, Beltsville, MD 20708 (301) 344-3431. Edward J. Robel, Jr. is at the USDA-ARS Avian Physiology Laboratory, Bldg. 262, BARC-E, Beltsville, MD 20708 (301) 344-2545.

Turkey Safety Tips

To make sure your holiday turkey doesn't turn you into a sick bird, here are a few rules that will help prevent food poisoning:

- Thaw your frozen turkey in the refrigerator.
- After it's thawed, wash it thoroughly inside and out. Then, wash your hands and any utensils you've used in hot, soapy water.
- Stuff the turkey immediately before you cook it: **NOT** the night before!
- Follow the cooking time and temperatures recommended on the label.
- After your meal, immediately store all leftovers in small portions in the refrigerator or freezer. **NEVER** leave food sitting out on the table over 2 hours!

Semidwarf Rice: A Giant in World Trade

Lemont, the Agricultural Research Service-developed rice that stood up to Hurricane Alicia and won, has had a more than $2 billion economic impact in Texas, Louisiana, and Mississippi since its release in 1983, according to Mary E. Carter, associate administrator of ARS.

She says the long grain semidwarf variety's lower cost of production also has almost singlehandedly kept U.S. rice competitive as an export to world markets.

"U.S. farmers' high-quality rice has always been in demand, but it was being priced out of the world market. With Lemont, the United States is able to stay in contention because it is significantly less expensive to produce," Carter says.

Lemont first attracted the attention of rice growers, and everyone else, when Hurricane Alicia hit the Texas rice belt dead center in 1983. The hurricane knocked down rice fields across the area except the seed rice fields planted in Lemont, according to plant breeder Charles Bollich, who heads the team that developed Lemont at the agency's Rice Research Laboratory located at the Texas A&M Research and Extension Center.

"Most of the rice in the path of the hurricane was flattened by Alicia's 100-miles-per-hour winds," Bollich says. "But there was Lemont in the middle of it all standing straight, despite the hurricane coming right over it. Less than 5 percent of it lodged (fell over), and it produced about 6,000 pounds per acre while other varieties yielded just over 3,000 pounds."

This towering resistance to lodging forms a major part of Lemont's economic vitality.

Rice production costs in Texas dropped from $12.43 per hundred pounds in 1983 before Lemont's introduction to $8.20 in 1987, according to a study by Jim Stansel, resident director of Texas A&M Research and Extension Center in Beaumont, Texas.

Lemont costs less to produce per hundred pounds because the semidwarf rice can be fertilized to the point of peak production. With non-semidwarf varieties, if a grower used the maximum amount of fertilizer, the chances are the rice plants would grow so tall that they would fall over or lodge, making it difficult to harvest.

"Before, growers had to play brinksmanship between highest yields and lodging," Bollich says. "With Lemont and peak fertilizing, in Texas there has been a 44-percent increase in yield; in Mississippi, 35 percent; and in Louisiana, 19 percent—without the worry of lodging."

Bollich says that Lemont's more than $2 billion impact, a figure also calculated by Stansel, includes the value added from increased yields, milling, processing, and the turnover of dollars in local economies.

Although the United States produces only 1 percent of the world's rice, half of the crop is exported, about 2.5 million tons in 1987. This accounts for about 25 percent of the world export market.

And the failure of the 1987 fall monsoon rains in India, Thailand, Indonesia and the Philippines caused the U.S. rice harvest to become even more important to the export market, according to Bollich.

"About 85 percent of the acres planted in Texas, 50 percent in Louisiana, and 70 percent in Mississippi, are planted in semidwarfs. And Lemont is the second leading variety in Arkansas," he says.

Lemont's resistance to lodging far outstrips what can be attributed solely to its semidwarf size, according to Bollich. "As a variety, it stands up to wind because it has sturdier stalks."

Additional fertilizing does make Lemont slightly more expensive to grow, according to Beaumont rice grower Bill Dishman, Sr., but that is more than offset by the increase in yield.

"Lemont has very literally meant being able to stay in the rice growing business," he said. "And, I can sleep nights now, instead of waking up dreading the sound of a thunderstorm flattening my rice."

Some of the yield increase is due to better management by growers. Along with the introduction of Lemont, the ARS and the Texas Agricultural Experiment Station developed an "ECONO-RICE" program to advise growers on how to handle the new variety and improve management.

"Without the improved growing practices taught by the ECONO-RICE program, Lemont would yield little more than traditional varieties," Bollich says. "Also under the ECONO-RICE program, we were able to combine funds contributed by rice producers with federal and state resources to speed up evaluation and seed production, which let us release Lemont to growers in record time."

Bollich's work has had a major impact on the U.S. rice industry for almost 20 years. In addition to Lemont, he has developed numerous other varieties such as Labelle, the first early maturing rice for the United States and Rexmont, a semidwarf long grain with superior cooking qualities.

In 1986 he released another semidwarf variety named Gulfmont, a close relative of Lemont, that matures a few days earlier. "We needed to give rice growers a way to spread harvesting time out a little," Bollich says. "With so much planted in Lemont, a grower has his whole crop come to harvest at the same time; he's got to get it all in in just a few days. This new variety produces as well as Lemont, but matures two or three days earlier easing the workload."

Gulfmont is performing very well and was planted on about 150,000 acres accross the South in 1988.—By **Kim Kaplan,** ARS.

Charles Bollich is at the USDA-ARS Rice Research Laboratory, Rt. 7, Box 999, Beaumont, TX 77713 (409) 752-2741. ♦

Dud Rams Cost Big Bucks

Most sheep producers would not keep a ewe that failed to breed and lamb every year. But when it comes to the male of the species, sheep producers often can't identify which rams are poor breeders.

Such rams can adversely lengthen the breeding and lambing season. And now research shows they may even disrupt or interfere with the breeding activities of good rams.

"The average ram is worth about $300 and costs $50 a year to maintain," says Agricultural Research Service animal scientist James A. Fitzgerald at the U.S. Sheep Experiment Station in Dubois, Idaho.

"About 15 out of every 100 rams in this country are sexually unproductive, at a cost of at least $7 million a year."

"Earlier studies have shown that the testes of these low-performers, or duds, are normal," says Anne Perkins, a doctoral candidate from the University of California, Davis, studying animal behavior at the Dubois station.

"And we've already demonstrated that the pituitaries of duds are normal," she says. "Therefore, we believe the differences we're finding in blood hormone levels are likely due to differences occurring in the brains of these animals."

About 84 percent of the rams tested in the Dubois study were productive; 16 percent were duds. A closer look at the duds revealed that some are not lacking sex drive; rather they are attracted to other males.

Being familiar with the ram's normal bisexual barnyard behavior, sheep ranchers haven't recognized dyed-in-the-wool homosexuals.

"Rams mounting other rams is considered normal behavior," says Perkins. "However, rams that persist in mounting males even in the presence of females in heat, we call homosexual. Half of the duds in the study were in this category."

"We believe sexuality depends on various combinations of hormones and how and when they're released in the body. The next step would be to investigate the pattern of hormone release in males exposed to females in heat and to compare that with patterns in both nonsexual and homosexual duds.

"We need to reach the point where we can provide producers with a quick, easy test they can use to tell the various performers apart," she says. "Identifying physiological differences in these sheep is just one step."—By **Howard Sherman,** ARS.

James A. Fitzgerald and Anne Perkins are at the U.S. Sheep Experiment Station, Dubois, ID 83423 (208) 374-5306. ♦

Hot Peppers Spice Up Profits for Farmers

If you like Louisiana Cajun cuisine, you may have encountered a new hot pepper, Carolina Cayenne.

Alec Gillespie, a small farmer in Neeses, South Carolina, was among the first to get to know this hot number. Since deciding to grow hot peppers, Gillespie has saved between $750 and $1,500 in nematode control expense.

Thanks to the work of Richard L. Fery and Philip D. Dukes of the U.S. Vegetable Laboratory in Charleston, South Carolina, and W.L. Ogle of Clemson University, Carolina Cayenne is endowed with resistance to the southern root knot nematode. The pepper was released in 1985. Last year, Gillespie planted 15 acres of Carolina Cayenne.

Gillespie says he not only saves on nematicide costs, but he can plant the new variety a few weeks earlier. With previous peppers, he had to wait longer after treating the soil because the nematicides would hinder seed germination.

Carolina Cayenne retains its commercially desirable red color when dehydrated, and this prompted him to buy equipment to dehydrate them on his farm. He then sells the dried peppers to a company that uses them to make sausage seasoning and in a batter mixture for Louisiana Cajun-style chicken.

"It turned my whole farm operation around," Gillespie says. "Last year, I made a substantial profit on peppers."—By **Sean Adams,** ARS.

Richard L. Fery is in the USDA-ARS Vegetable Laboratory, 2875 Savannah Highway, Charleston, SC 29414 (803) 556-0840. ♦

ARS geneticist Richard Fery (left) and plant pathologist Philip Dukes (center) check Carolina Cayenne peppers with grower Alec Gillespie. (88BW1819-34)

ROB FLYNN

Australian Chestnut Serves Two Purposes

An Australian tree is getting plenty of attention from scientists these days. Not only is the National Cancer Institute studying the Moreton Bay chestnut as a source of a potential anti-AIDS drug, but Agricultural Research Service plant scientists are checking out its qualifications as a marketable houseplant.

James A. Duke, a botanist with ARS in Beltsville, Maryland, acquired the seed of the tree from its native habitat in the rain forests of Australia, after learning that the National Cancer Institute (NCI), Bethesda, Maryland, was investigating an extract from the seed as a possible anti-AIDS drug.

According to an NCI official, laboratory tests show that castanospermine, a chemical extracted from the seed, prevents the AIDS virus from killing healthy cells.

"The chemical is extracted by water and purified with chromatography. Simply crushing the seed is not going to give you castanospermine," says Duke.

"The seed must be purified because it contains toxins in its natural state. Therefore, it should not be chewed," he cautions.

Although it is grown outdoors in California and as an ornamental in Australia and South Africa, this is the first time the Moreton Bay chestnut has been proposed as a houseplant for U.S. consumers.

The plant looks somewhat like the popular Benjamin fig except the leaves are slightly larger and more glossy.

Grown as a low-maintenance plant, the chestnut needs water about every other day. It grows under fluorescent light as well as in direct sunlight.

"In its natural environment outside, it towers to over 100 feet tall," Duke says. "Inside in containers it grows to about 6 feet, although it could possibly reach 30."

TIM McCABE

Moreton chestnuts contain castanospermine, a possible anti-AIDS drug. (88BW0739-13)

But to survive outdoors, the plant needs a Mediterranean-like climate.

Duke stresses that the ornamental research is just starting. He has two trees that are 12 inches tall and will be propagating more from seeds planted in greenhouses at the Agricultural Research Center in Beltsville.

Not a true chestnut, the *Castanospermum australe* belongs to the legume family. Plants from this family include beans, peas, carob, and licorice. In ancient times, Duke says, Australian aborigines derived a food high in starch from the pulp of the seed; the toxins were removed by traditional processing methods.

Duke says that germplasm from the Moreton Bay chestnut will be placed in an ARS germplasm collection. The agency preserves germplasm of several thousand plant species, which is made available to researchers throughout the world. This raw genetic material helps improve plant quality and yield, increase disease resistance, and explore alternative uses for existing plants.—By **Doris Sanchez,** ARS.

James A. Duke is in the USDA-ARS Germplasm Introduction and Evaluation Laboratory, Beltsville Agricultural Research Center-West, Beltsville, MD 20705 (301) 344-4419. ♦

Russian Wheat Aphids Invade

Carried on the wind from 2 counties in Texas to 14 western states and the Canadian provinces of Alberta and Saskatchewan, the Russian wheat aphid—a newly imported pest—has become the scourge of crop fields. Not only does the insect spread disease and poison the leaves as it feeds, it also creates its own haven from pesticides in the leaves it damages. Once the leaves curl, the pest is sheltered from pesticides. To fight this single insect, pesticides costing $17.2 million were applied last year alone.

The pest, originating in Russia, Iran, and Afghanistan, was first detected in the Texas panhandle in 1986. It has since spread to Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming, with 60 million acres of cereal cultivation considered susceptible to its attack. Officials expect the aphid, which appears to have entered the United States from Mexico, to continue spreading.

These days, scientists are ganging up against the pest, which ravaged $36 million worth of wheat, barley, oats, and rye last year.

Richard S. Soper, national program leader for biological control in the Agricultural Research Service, says that the new program was designed with the curly leaf problem in mind. "We will look for methods that will work even if pests are protected underneath curled leaves." Here's an outline of their plan:

• Resistant varieties of wheat and other crops will be the focus of James Webster and Owen Merkle at the Wheat and Other Cereal Crops Research Laboratory in Stillwater, Oklahoma.

• Biological controls—such as other insects or diseases—to control the aphid will be the center of attention at the European Parasite Laboratory in Behoust, France, headed up by

Ray Moore. Tad Poprawski and Francis Gruber will travel to Spain, Turkey, Bulgaria, Yugoslavia, Romania, Greece, and elsewhere to look for potential new agents.

Soper pointed out that in its native habitat the aphid is not a pest problem. "It is likely being kept in check by natural enemies there," he says, "so we have high hopes for biological controls."

• Putting mulch under crops is known to repel other aphids. Robert Burton at the Stillwater laboratory will test this and other cultural methods against the Russian wheat aphid.

• Screening insecticides will be one project at the Northern Grain Insects Laboratory in Brookings, South Dakota, headed by Gerald Sutter.

• Computers at the Brookings lab will help Gerald Sutter and his group there organize all the information gathered by researchers on the aphid. "Our goal," Soper says, "is to develop simulation models that include interactions of the aphid and its natural enemies to devise integrated control strategies for managing the pest under different conditions."—By **Jessica Morrison,** ARS.

Richard S. Soper is the USDA-ARS National Program Leader for Biological Control, National Program Staff, Bldg. 005, Beltsville, MD 20705 (301) 344-3930. ♦

PATENTS

New Virus Mix Kills Insects in Raisins

A powerful natural virus that kills raisin-eating moths may someday be applied to that food as an almost invisible tasteless and odorless protective powder or spray mist.

It would take only one-quarter teaspoon of the granulosis virus mixture to protect 450 one-pound boxes of raisins from the Indianmeal moth, says ARS research entomologist Patrick V. Vail at the Horticultural Crops Research Laboratory, Fresno, California.

Yet that protection won't alter the taste, texture, or appearance of the raisins. And safety tests, required before the virus mix could be approved for use on raisins or other stored foods that the moth eats, are expected to show that the virus is harmless to humans.

Indianmeal moth ranks as one of the top three pests of stored raisins, which is why the California Raisin Advisory Board funded part of the research. The insect is also a major headache for packers or processors of other dried fruits, including apricots and prunes, nuts such as almonds and walnuts, and grains like wheat and barley.

The adult moth is small and silvery, with narrow, blunt-tipped wings. It's the one that may "fly out at you when you open the kitchen cupboard," Vail says.

The process he developed for producing large quantities of the virus is less expensive and more effective than other ways researchers have suggested for putting the virus to work in warehouses and packing plants where the moth is a continuing problem.

To produce the virus mix, the insects are reared from eggs in the laboratory. Their meals are a combination of wheat bran, yeast, and vitamins. Honey and glycerol, two ingredients other researchers had suggested were critical sources of vitamins, minerals, and sugar for the insects, are left out because they're sticky. They had to be washed off in later steps, driving up costs.

The larvae (wormlike stage) that hatch from the eggs are incubated for 10 days at 80°F until they are about half-grown. Then their food is spiked with ground-up remains of a small number of laboratory-reared larvae that had been exposed to the virus. After a second incubation stint of another 10 days at 80°, about 90 percent of the larvae will come down with the virus.

By this time, the viruses in their bodies will have increased millions of times. "They have essentially served as little factories for quickly producing a huge amount of virus," Vail says.

That's when larvae and food, along with some water, go into the blender. The resulting slurry, loaded with active virus, is freeze-dried, then milled to a fine, buff-colored powder, about the consistency of bleached flour. The powder could be used right away or could be stored in a refrigerator or freezer.

The virus mix could be added to water, then sprayed on the food. Or it could be blended with a carrier, such as milled wheat bran, then lightly dusted on raisins. Another option could be to use the virus mix in combination with an insect attractant to lure adult moths to a trap where they'd be exposed to the virus.

Vail says the virus mix is a natural biological control that with further development might give food processors an alternative to chemical fumigants.

For technical information about this patent, contact Patrick V. Vail, USDA-ARS Horticultural Crops Research Laboratory, 2021 South Peach Ave., Fresno, CA 93927 (209) 453-3000.—By **Marcia Wood,** ARS.

Patent application serial number 07/212,641, "Novel Virus Composition To Protect Agricultural Commodities From Insects."

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